WP 07-EU1301

Revision 13

Manually Acquired Geomechanical Instrument Data

Technical Procedure

EFFECTIVE DATE: 01/15/19

Rey Carrasco
APPROVED FOR USE

THIS DOCUMENT IMPLEMENTS REQUIREMENTS FOR THE HWFP.

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CHANGE HISTORY SUMMARY

REVISION NUMBER	DATE ISSUED	DESCRIPTION OF CHANGES
12	04/27/17	• Validation performed by Sam Dominquez • Updated format to new template • Added more clarification in section 5.6 Note regarding extensometer inspection • Added “all active instruments” in step 5.6.1.
13	01/15/19	• Updated JHA reference. • Added inspection clarification with respect to extensometers in Note of Section 5.6.

1.0 INTRODUCTION

1.1 PURPOSE

This document provides methods used for manually acquiring data from GIS in the WIPP repository. The methods described in this document include:

- Manual collection of data from convergence points
- Multi-position borehole extensometers
- Piezometers
- Strain gages
- Earth pressure cells
- Rockbolt load cells

The instruments are read to monitor changes due to deformation of underground openings, shafts, and changes in lithostatic and hydrostatic pressures within the rock around underground openings.

Geomechanical monitoring of drifts, rooms, and shafts are performed to provide in situ data on the behavior of the rock around these openings. Such monitoring provides early detection of conditions that affect operational safety, monitor closure rates, and provides a better understanding of in situ behavior of bedded salt by comparison of observed response with design calculations. Measurements of salt deformation and stresses are used to confirm or revise the opening configuration and parameters used in facility design.

1.2 SCOPE

This procedure is to be performed by Geotechnical personnel. Training requirements for performance of this procedure are identified in WP 09, Conduct of Engineering.

Performance of this procedure, or selected sections of the procedure, implements inspection requirements of the Hazardous Waste Facility Permit (HWFP) and as defined in this document.

1.3 RECORDS

Records generated are handled per departmental RIDS. Performance of this procedure generates the following record(s).

- Attachment 1, Tape Extensometer Check Calibration Sheet
- Attachment 2, GIS Field Data Sheet
- Attachment 3, GIS Extensometer Reset Data Sheet
- Attachment 4, GIS Field Data Sheet
- Attachment 5, Sample GIS Field Data Sheet

Attachment 5, Sample GIS Field Data Sheet, is a sample form generated by GeoSchedule, a scheduling software application. All references made to Attachment 5 refer to the actual form. If Attachment 5 is being used, and if either of the items listed below occur prior to the page being completed, readings affected should be indicated in the comments section.

- A change in personnel performing readings
- A reading device is replaced with one that performs the same function

2.0 REFERENCES

DOCUMENT NUMBER AND TITLE	BASELINE DOCUMENT	REFERENCED DOCUMENT	KEY STEP
Hazardous Waste Facility Permit, EPA Identification Number NM4890139088-TSDF	✓		**($)**
WP 07-1, WIPP Geotechnical Engineering Program Plan	✓		
WP 07-EU1303, Geomechanical Instrument Data Processing		✓	
WP 09, Conduct of Engineering		✓	
WP 10-AD.01, Metrology Program	✓		
WP 13-1, Nuclear Waste Partnership LLC Quality Assurance Program Description	✓		
WP 15-GM1002, Issues Management Processing of WIPP Forms		✓	
Instrument Document No. 2, Vibrating Wire Spot Welded Strain Gage, Geomechanical Instrumentation, Waste Isolation Pilot Plant, prepared for Cementation West, Inc., Tucson, Arizona by Soil & Rock Instrumentation Division, Goldberg-Zoino & Associates, Inc., Newton Upper Falls, Massachusetts, SRI Document No. F5-002, Rev. 000, SRI File No. B-3217-F5, February 1982.	✓		

DOCUMENT NUMBER AND TITLE	BASELINE DOCUMENT	REFERENCED DOCUMENT	KEY STEP
Instrument Document No. 3, Vibrating Wire Embedment Strain Gage, Geomechanical Instrumentation, Waste Isolation Pilot Plant, prepared for Cementation West, Inc., Tucson, Arizona by Soil & Rock Instrumentation Division, Goldberg-Zoino & Associates, Inc., Newton Upper Falls, Massachusetts, SRI Document No. F5-003, Rev. 001, SRI File No. B-3217-F5, March 1982.	✓		
Instrument Document No. 4, Vibrating Wire Earth Pressure Cell, Geomechanical Instrumentation, Waste Isolation Pilot Plant, prepared for Cementation West, Inc., Tucson, Arizona by Soil & Rock Instrumentation Division, Goldberg-Zoino & Associates, Inc., Newton Upper Falls, Massachusetts, SRI Document No. F5-004, Rev. 001, SRI File No. B-3217-F5, March 1982.	✓		
Instrument Document No. 5, H-300 Load Cells, Geomechanical Instrumentation, Waste Isolation Pilot Plant, prepared for Cementation West, Inc., Tucson, Arizona by Soil & Rock Instrumentation Division, Goldberg-Zoino & Associates, Inc., Newton Upper Falls, Massachusetts, SRI Document No. F5-005, Rev. 000, SRI File No. B-3217-F5, March 1982.	✓		
Instrument Document No. 6, Vibrating Wire Piezometer, Geomechanical Instrumentation, Waste Isolation Pilot Plant, prepared for Cementation West, Inc., Tucson, Arizona by Soil & Rock Instrumentation Division, Goldberg-Zoino & Associates, Inc., Newton Upper Falls, Massachusetts, SRI Document No. F5-006, Rev. 000, SRI File No. B-3217-F6, March 1982.	✓		
Instrument Document No. 8, Multi-position Borehole Extensometer, Geomechanical Instrumentation, Waste Isolation Pilot Plant, prepared for Cementation West, Inc., Tucson, Arizona by Soil & Rock Instrumentation Division, Goldberg-Zoino & Associates, Inc., Newton Upper Falls, Massachusetts, SRI Document No. F5-008, Rev. 000, SRI File No. B-3217-F5, March 1982.	✓		

DOCUMENT NUMBER AND TITLE	BASELINE DOCUMENT	REFERENCED DOCUMENT	KEY STEP
Instrument Document No. 11, Tape Extensometer, Geomechanical Instrumentation, Waste Isolation Pilot Plant, prepared for Cementation West, Inc., Tucson, Arizona by Soil & Rock Instrumentation Division, Goldberg-Zoino & Associates, Inc., Newton Upper Falls, Massachusetts, SRI Document No. 05-011, Rev. 000, SRI File No. B-3217-F5, April 1982.	✓		
Displacement Transducer Model 4040 Instruction Manual, Publication No. KA069876-001, Research Inc., February 1988.	✓		
07-EU1301-JHA, Manually Acquired Geomechanical Instrument Data	✓		

2.1 ABBREVIATIONS AND ACRONYMS

CE	Cognizant Engineer
CMRO	Central Monitoring Room Operator
GIS	Geomechanical Instrumentation System
M&DC	Monitoring and Data Collection
RIDS	Records Inventory and Disposition Schedules
RWP	Radiological Work Permit
SEC	Site Environmental Compliance
WIPP	Waste Isolation Pilot Plant

3.0 PRECAUTIONS AND LIMITATIONS

3.1 PRECAUTIONS

- **EYE, FOOT, HEAD, HAND HAZARDS** exist. Personnel may be exposed to sharp edges and overhead hazards. Personnel will wear a hard hat, leather gloves (mechanics), safety glasses with side shields, and safety/hard toed shoes.
- **FALLS FROM ELEVATED WORK HEIGHT HAZARDS** exist. Personnel will be trained in Fall Protection and Ladder Use.

- **GROUND CONTROL HAZARDS** exist. Personnel may be exposed to ground control hazards while performing underground activities. Personnel will use a hand scaling bar to remove loose rock. Personnel will inspect area before beginning work and will not perform work alone.
- **HEAT STRESS HAZARDS** exist. Personnel may experience heat stress while performing work. Personnel will use work/rest regimen and cool vests.
- **MOVING/FALLING OBJECTS HAZARDS** exists during equipment operations. Personnel will stand clear of moving equipment and/or material/loads. Personnel be mindful when working around elevated work platforms.
- **NOISE HAZARDS** exist. Personnel may be exposed to noise hazard due to cleaning equipment with compressed air. Personnel will wear hearing protection.
- **OVERHEAD UTILITIES UNDERGROUND HAZARDS** exist. Personnel may perform work around overhead utilities in the underground. A Spotter is required when working around overhead utilities in the underground. Personnel will avoid contact between extension pole and power cables.
- **PINCH POINT HAZARDS** exist. Leather gloves (Mechanics) will be worn when pinch point hazards are present. Personnel will use situational awareness to avoid pinch points before beginning work.
- **POOR ILLUMINATION HAZARDS** exist. Personnel may be exposed to poor illumination in the underground. Personnel may use temporary lighting and cap lamps in the underground.
- **RADIOLOGICAL HAZARD** exists in contaminated areas. Work will be performed in accordance with approved RWP.
- **SLIP/TRIP HAZARDS** exist during general operations. Housekeeping and situational awareness shall be maintained.
- **VEHICLE TRAFFIC/HEAVY EQUIPMENT HAZARD** exists during general operations. A Spotter is required, a high visibility vest will be worn, and Operator will ensure travel surface is suitable.
- **VENTILATION HAZARDS** exist in the underground. Personnel will ensure adequate ventilation prior to work in the underground.

3.2 LIMITATIONS

- The RB-100 does not have an automatic SHUT OFF power switch; therefore, the unit must be switched OFF when not in use.

4.0 PREREQUISITE ACTIONS

4.1 **PERFORM** a pre-job safety briefing **AND DISCUSS** hazards and hazard mitigations in 07-EU1301-JHA, Manually Acquired Geomechanical Instrument Data.

4.2 **IF** working in a radiation area,
THEN REVIEW AND ENSURE requirements of the RWP are met.

4.3 **ENSURE** all instruments are within their current calibration interval prior to use.

4.4 Equipment List

- Tape Extensometer, Geokon Model 1610
- Portable Vibrating Wire Readout Unit, Geokon GK-404
- Strain Indicator – Vishay (P3500)
- Linear Potentiometer Readout Unit, Geokon RB-100

5.0 PERFORMANCE

NOTE

M&DC equipment used in gathering data shall be calibrated according to calibration and maintenance schedule per WP 10-AD.01, Metrology Program. Calibration methods and intervals are based on manufacturer's recommendations.

5.1 TAPE EXTENSOMETER

5.1.1 **CHECK** reference point eyebolts for signs of physical disturbance or damage.

[A] **ENSURE** tape extensometer is within its current calibration.

[1] **IF** tape extensometer shows signs of physical disturbance or damage,
THEN READ tape extensometer on fixed calibration frame **AND COMPARE** value to previous frame reading.

[2] **CONTACT** CE if difference is greater than 0.050.

5.1.2 **IF** extension pole is NOT being utilized,
THEN PERFORM the following:

[A] **CLEAN** eyebolt of dirt AND debris
AND ATTACH snaphook on end of tape extensometer to eyebolt.

[B] **UNREEL** tape extensometer while carrying instrument to opposite reference point.

[C] At opposite reference point, **ATTACH** hook on end of instrument to eyebolt on reference point.

5.1.3 **IF** extension pole is being utilized,
THEN PERFORM the following:

[A] **INSPECT** extension pole for damage.

[B] **ADJUST** extension pole so bottom of pole is at a height satisfactory to tape extensometer Operator.

[C] **ATTACH** tape extensometer to extension pole.

[D] **UNREEL** tape extensometer **AND ATTACH** to bottom reference point.

5.1.4 **WIND UP** excess slack in tape extensometer,
AND RUN measuring tape along backside of instrument through slot in head
AND ATTACH to Tape Locking Pin in nearest punched hole.

5.1.5 **ENSURE** tape extensometer is securely anchored on Tape Locking Pin.

5.1.6 **TURN** adjusting knob clockwise.

NOTE

The Geokon Model 1610 extensometer has indicator lights that come on to indicate proper tension.

5.1.7 **TURN** tape tensioning winding handle clockwise until red indicator light comes on.

5.1.8 **TURN** winding handle back until light turns green.

5.1.9 **IF** tape extensometer cannot be aligned due to lack of travel adjustment,
THEN POSITION Tape Locking Pin in next available punched hole **AND GO TO** Step 5.1.4.

NOTE

At this point, the extensometer has approximately 23 lbs of tension on the tape. Readings will be taken with the extensometer unsupported.

5.1.10 **IF** initial installation,
THEN RECORD tape, digital gage readings, and extension pole position, if used, on WP 07-EU1303, Geomechanical Instrument Data Processing, Attachment 1, GIS Initial Data Sheet.

5.1.11 **IF** not initial installation,
THEN RECORD tape reading at Tape Locking Pin, dial/digital gage reading, and extension pole position, if used, on Attachment 2, GIS Field Data Sheet, or GeoSchedule datasheet (similar to Attachment 5, Sample GIS Field Data Sheet), as applicable.

5.2 GK-404 VIBRATING WIRE READOUT UNIT

NOTE

Steps in Section 5.2 provide operating instructions for normal use of Geokon GK-404.

CAUTION

These connectors are a one-way fit. Forcing mating of connectors will cause damage to connectors.

5.2.1 **CONNECT** supplied blue jumper cable to GK-404 aligning red symbols together.

5.2.2 **CONNECT** GK-404 supplied blue jumper cable with corresponding instrument wire colors.

5.2.3 **ENSURE** display is reading properly Pos (B), Reading (-Dg).

[A] **IF** incorrect reading is displayed,
THEN PRESS POS button until (B) is displayed and MODE button until (-Dg) is displayed.

5.2.4 **CONNECT** GK-404 portable readout to instrument cable.

5.2.5 **IF** initial reading,
THEN RECORD data and installation information on WP 07-EU1303, Geomechanical Instrument Data Processing Attachment 1, GIS Initial Data Sheet.

5.2.6 **IF** not initial reading,
THEN RECORD reading on Attachment 2, GIS Field Data Sheet, or GeoSchedule datasheet (similar to Attachment 5, Sample GIS Field Data Sheet), as applicable.

5.3 VISHAY P-3500 DIGITAL STRAIN INDICATOR READOUT UNIT

NOTE 1

Steps in Section 5.3 provide operating instruction for normal use of Vishay P-3500 Digital Strain Indicator Readout Unit. The P-3500 is used to read resistive strain gages and load cells.

NOTE 2

When the BRIDGE button is depressed, yellow display indicates FULL-BRIDGE mode and black display indicates ¼ - ½ BRIDGE mode.

5.3.1 **DETERMINE** transducer bridge configuration by selecting full-bridge configuration quarter- or half-bridge configuration.

NOTE

When MULT button is depressed, yellow display indicates X10 mode and black indicates X1 mode.

5.3.2 **SELECT** X1 position by pushing the MULT button.

5.3.3 **CONNECT** strain gage(s) or load cell to colored binding posts or TRANSDUCER connector.

NOTE

When AMP ZERO button is depressed, POWER button will pop up, causing button panel to change to black.

5.3.4 **PERFORM** the following while in X1 mode:

[A] **PUSH IN** the AMP ZERO button, when button is pushed, the readout display should come on.

[B] **ALLOW** unit to warm up for a minimum of two minutes.

[C] Using AMP ZERO control, **SET** readout display to (+/-) 0000.

[D] **PRESS** lightly with fingertip
AND ROTATE until the displayed reading is (+/-) 0000.

5.3.5 **PRESS** GAGE FACTOR button
AND VERIFY button panel turns orange.

NOTE

When the gage factor of approximately 2.0 is being used, the 1.7 to 2.5 range will result in the optimum setting capability.

5.3.6 **SET** GAGE FACTOR range selector to range under which the desired gage factor falls.

5.3.7 **UNLOCK** GAGE FACTOR control knob by pushing locking mechanism counterclockwise.

5.3.8 **SET** exact gage factor value by turning GAGE FACTOR control knob.

5.3.9 Once gage factor has been set, **LOCK** GAGE FACTOR control knob by pushing locking mechanism clockwise
AND VERIFY knob is locked.

5.3.10 **PRESS** RUN push button
AND VERIFY button panel turns green.

5.3.11 **SET** MULT to X1 mode
AND PERFORM the following:

[A] **SET** BALANCE selector to zero.

[B] **UNLOCK** BALANCE control knob by pushing locking mechanism counterclockwise.

5.3.12 **SET** BALANCE control knob to display reading (+/-) 0000.

5.3.13 **PRESS** CAL push button
AND VERIFY calibration of instrument.

5.3.14 **SELECT** X1 or X10 MULT position.

5.3.15 **PRESS** RUN push button
AND RECORD displayed reading on Attachment 2, GIS Field Data Sheet.

NOTE

Steps in Section 5.4 give operating instruction for normal use of the Geokon RB-100 Linear Potentiometer Readout Unit. The RB-100 is used to read a single or multiple linear potentiometers.

5.4 RB-100 LINEAR POTENTIOMETER READOUT UNIT

5.4.1 **CONNECT** potentiometer cable to either single input or multiple input connector marked PROBE on the RB-100.

CAUTION

These connectors are a one-way fit. Forcing the mating of connectors will cause damage to the connectors.

5.4.2 **PUSH** POWER switch to ON position.

5.4.3 **SET** RANGE selector to the appropriate range of the potentiometer.

5.4.4 **RECORD** reading on Attachment 2.

5.4.5 For a multi potentiometer transducer,
MOVE POSITION selector to desired potentiometer
AND RECORD reading on Attachment 2.

5.4.6 **SWITCH** POWER to OFF.

5.5 MANUALLY ACQUIRED ROTARY POTENTIOMETER READINGS

5.5.1 **CONNECT** instrument to connector P1 on potentiometer interface.

5.5.2 **CONNECT** voltmeter to connector P2 on potentiometer interface.

5.5.3 **ENSURE** voltmeter is set to read DC voltage.

NOTE

Initial instrument voltmeter readings should be recorded on Attachment 1, GIS Initial Field Data Sheet, of WP 07-EU1303, Geomechanical Instrument Data Processing.

5.5.4 **DOCUMENT** the following readings on Attachment 4, GIS Field Data Sheet:

[A] Potentiometer interface selector switch set to V_{ex} position.

[B] Potentiometer interface selector switch set to V_{in} position.

5.5.5 **SEQUENCE** selector switch through any additional transducers while recording the output of each.

HWFP 5.6 **($)** MONTHLY UNDERGROUND GIS INSPECTIONS **[HWFP TABLE E-1]**

NOTE

A visual inspection of accessible geotechnical instrumentation for deterioration is limited to those parts of instruments located on the strata surface of underground facility. Extensometers are to be inspected from the ground looking for conditions in Step 5.6.1.

5.6.1 **CHECK** scheduled instruments for cracks, erosion, salt buildup, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration **AND DOCUMENT** abnormalities in the comment section of the appropriate attachment.

5.6.2 **IF** a HWFP required inspection becomes delinquent or has failed, **THEN PERFORM** the following:

[A] IMMEDIATELY **NOTIFY** the SEC On-Call Representative and the CMRO of the delinquent or failed inspection.

[B] **RESCHEDULE AND COMPLETE** required inspection.

[C] For failed or delinquent inspections, **DOCUMENT** the following **AND SUBMIT** to PermitInspections.wipp.ws within five working days of discovery:

- Inspection document #
- Description of facility, equipment involved
- Schedule for inspection
- Reason(s) why the inspection was not performed or failed
- Compensatory measures taken to offset negative impacts from not performing the inspection or the equipment not providing its intended function
- Actions to prevent further delinquencies

[D] Manager, **GO TO** WP 15-GM1002, Issues Management Processing of WIPP Forms, **AND ENSURE** a WIPP form is generated.

Attachment 1 - Tape Extensometer Check Calibration Sheet

TAPE EXTENSOMETER
CHECK CALIBRATION SHEET

CALIBRATION RUN BY _____ DATE _____

CALIBRATION CHKD. BY _____ DATE _____

TAPE EXTENSOMETER MANUFACTURER _____

TAPE EXTENSOMETER S/N _____ WIPP CALIBRATION LAB ID. No. _____

CALIBRATION FIXTURE S/N _____ WIPP CALIBRATION LAB ID. No. _____

CALIBRATION FIXTURE TEMPERATURE (°F) _____

TRIAL NUMBER	READINGS						SUM
	TAPE		DIAL (INCHES)				
	FEET	INCHES	INCHES	0.1	0.01	0.001	
1							
2							
3							
4							
5							
6							
7							
8							
						AVERAGE	
						AVERAGE FROM PREVIOUS CALIBRATION	
						CHANGE FROM PREVIOUS CALIBRATION	

CHANGE ACCEPTANCE CRITERION: +/- 0.003 INCHES ACCEPT ☐ REJECT ☐

COMMENTS AND CONCLUSIONS

_____

_____

_____

_____

Completed By: _____ / _____ / _____
Print Name Signature Date

Checked By: _____ / _____ / _____
Print Name Signature Date

Attachment 2 - GIS Field Data Sheet

GIS FIELD DATA SHEET

DATE ____/____/____ TIME _____ READINGS BY _____

FIELD TAG ENTITY	READING	GISID

STATION: _____

INSTRUMENT TYPE: _____

READING DEVICE: _____

SERIAL NUMBER: _____

CHECK: _____

COMMENTS: _____

_____

_____

_____

($) Check for cracks, erosion, salt buildup, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration. **[HWFP Table E-1]** SAT [ ] UNSAT [ ]

Completed By: _____ / _____ / _____

Print Name Signature Date/Time

Attachment 3 - GIS Extensometer Reset Data Sheet

GIS EXTENSOMETER RESET DATA SHEET

FIELD TAG _____ RESET BY _____

LOCATION _____

READING DEVICE _____ SERIAL NUMBER _____

RESET ACTIVITY BEGUN: DATE ___/___/___ TIME _____

#	READING
1	
2	
3	
4	
5	
6	

RESET ACTIVITIES		
1		
2		
3		
4		
5		
6		
#	DEPTH OF ROD	LENGTH ADDED

COMMENTS _____

RESET ACTIVITY COMPLETED: DATE ___/___/___ TIME _____

#	READING
1	
2	
3	
4	
5	
6	

READINGS ALTERED MORE THAN ±0.010			
BEFORE	AFTER	CHANGE	GISID

DATA REDUCTION BY _____ DATE ___/___/___

CHECKED BY _____ DATE ___/___/___

Attachment 4 - GIS Field Data Sheet

GIS FIELD DATA SHEET

DATE ____/____/____ TIME _____ READINGS BY _____

FIELD TAG ENTITY	READING	GISID
V_{ex}		
V_{in}		
A		
B		
C		

STATION: _____

INSTRUMENT TYPE: _____ WEX: _____

READING DEVICE: _____

SERIAL NUMBER: _____

CHECK: _____

COMMENTS: _____

_____

_____

_____

($) Check for cracks, erosion, salt buildup, damage, corrosion, loose or missing parts, malfunctions, and structural deterioration. **[HWFP Table E-1]** SAT [ ] UNSAT [ ]

Completed By: _____ / _____ / _____
Print Name Signature Date/Time

Attachment 5 - Sample GIS Field Data Sheet

GIS FIELD DATA SHEET

GISID	LOCATION	TYPE	READING	DATE
18713	E0 DRIFT-N1100 A-C	CVPT		/
18714	E0 DRIFT-N1266 A-C	CVPT		/
18564	E0 DRIFT-N225 A-C	CVPT		/
18541	E0 DRIFT-N225 B-D	CVPT		/
18542	E0 DRIFT-N290 A-	CVPT		/
18565	E0 DRIFT-N460 A-C	CVPT		/
18673	E0 DRIFT-N562 A-C	CVPT		/
18674	E0 DRIFT-N562 B-D	PT		/
18675	E0 DRIFT-N626 A-C	T		/
18676	E0 DRIFT-N686 A-C	CVPT		/
18677	E0 DRIFT-N686 B-D	CVPT		/
18711	E0 DRIFT-N780 A-C	CVPT		/

Check for cracks, erosion, salt build-up, damage, corrosion, loose or missing parts, malfunctions and structural deterioration.

Comments: _____

Read/Inspected by: _____

Readings due date: 4/2/2004

Provide the information required below for the readout devices used in the collection of the readings recorded on this page:

Reading device: _____ Device ID: _____ Calibration due: _____

Reading device: _____ Device ID: _____ Calibration due: _____

Reading device: _____ Device ID: _____ Calibration due: _____

Reading device: _____ Device ID: _____ Calibration due: _____